SOME MATERIALS AND METHODS FOR TEACHING FORESTRY IN NORTH CAROLINA HIGH SCHOOLS

by

Voigt F. Morgan

Approved by:

Herbert Way
Chairman of Thesis Advisory Committee

Chapell Wilson
Director of Graduate Study

Herbert Way
Major Professor

F. Ray Derrick
Minor Professor

SOME MATERIALS AND METHODS FOR TEACHING FORESTRY IN NORTH CAROLINA HIGH SCHOOLS

An Abstract of a Thesis
Presented to
the Faculty of the Department of Education
Appalachian State Teachers College

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Education

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Voigt Fritz Morgan
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This study was proposed (1) to teach high school students a basic course in forestry (2) to carry out an extensive study of units dealing with different methods, techniques and materials for teaching forestry and (3) to make recommendations concerning some methods and materials that are adaptable to teaching forestry in secondary schools of North Carolina.

Data were collected from the literature and reviewed. This review formed a foundation for further study which included the history and present situations of the forests (use, enemies, and conservation) and showed the need for more education in forest conservation.

The evaluation of methods and projects undertaken by the author and the students showed that projects are one of the best methods of teaching and that by developing them in various ways, many education techniques can be developed. The surveys formed a basis from which a nature trail was developed. From the trail, collections were made. Then growth of trees (a method demonstration), reproduction of trees, planting of trees (a method and result demonstration), protection by forests, and products of the forests (a research problem) were units undertaken.

From the actual experiences and data studied, recommended methods and materials are shown. Result demonstration, method demonstration, supplementary material,

exhibits, collections, visual aids, resource visitors, and projects are some suggested methods. Some rules for teachers and students to observe in making field trips are given. The projects suggested include leaf collections and tree identification, surveys, growth of trees, forest reproduction, forest planting, protection by the forests, and products from the forests.

The author recommends that (1) students in secondary schools be given a basic course in forestry and forest conservation, (2) the course be a supplement to the biology text in current use, (3) the course consume no more than six weeks, (4) the work be correlated with springtime biology unit, where time is limited, and (5) more projects of this nature be used in science courses.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

The forests have been, and still are, one of the nation's most important natural resources. Not only do they play a leading part in the economic and industrial life of the nation today but they also serve us in many other ways. By checking the rains and melting snows, they help prevent erosion and floods; they are a source of many products; they make a home for game and wildlife; they furnish opportunities for recreation; and they make this country a more pleasant and more beautiful place in which to live. If we were to be totally deprived of forests, we would suffer economically, physically, and esthetically. In fact, it is doubtful if we would survive as a nation. It is therefore important that we know how to handle our forest wealth so that it may be used to fill our countless needs and at the same time continue a permanent natural resource. This can be done only by learning the ways of trees and forests, what forestry is, and what the practice of it means to the American people.[1]

I. THE PROBLEM

Statement of the problem. As a teacher of science in secondary schools, I have found much material in forestry, but

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[1] Charles E. Randall and Marie Heisley, Our Forests: What They Are and What They Mean To Us (Washington: Department of Agriculture, 1944), p. 2.

not in the textbooks or in an organized form to teach high school students. Therefore I have spent part of a year of study and research in the field of basic forestry with high school students. The work with the students was correlated with biology courses. On the basis of this study, I propose to offer recommendations for setting up a program of teaching forestry and its vital importance to students in secondary schools.

The purpose is to investigate the feasibility of teaching forestry in secondary schools and to make recommendations that will help teachers of science to carry out certain units of work in the field of forestry.

Major aspects of the problem are:

1. Review of much available literature dealing with forestry and forestry teaching.
2. Carry out an extensive study of units dealing with different methods, techniques, and materials for teaching forestry during the school year of 1952 and 1953 at Alamance High School, Guilford County, North Carolina for a period of six weeks.
3. On the basis of this year's work in actual teaching, make recommendations concerning some methods and materials that are adaptable to teaching forestry in secondary schools of North Carolina.

Importance of the study. Our woodlands are a great responsibility. They have been abused for the past three hundred years; probably because we thought they were so big they would last forever.[2] Now they must be rebuilt. With this in mind, the author thinks it most important to teach the youth of today, who will be the leaders of tomorrow, the status and importance of our forests and remedial practices.

The expected outcome of this study is to create among our future leaders (who are today's students) a knowledge of forestry and to show them the need for forest conservation, which may contribute to the social, recreational, and economic well-being of our country. It is also expected that this study will aid the teachers, who find themselves in the author's position of not being able to find sufficient material on forestry in many of the present texts, by giving them recommendations and materials to use in their work. These recommendations are based on the results of the study.

II. DEFINITIONS OF TERMS USED

Forests. A forest is more than a mere group of trees. It is a highly organized community of plants and animals living in close association and in varying degrees of interdependence.[3]

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[2] Norbert H. Sand and Milton M. Bryan, Managing the Small Forest (Washington: Department of Agriculture), p. 1.

[3] Randall and Heisley, op. cit., p. 2.

A forest is also a laboratory in which natures creates oxygen enabling mankind to exist upon the earth; a factory in which are produced many raw materials for making dozens of products used in our daily lives; a bank in which the owner may leave on deposit the earnings of his investment to be drawn out as necessity may require; a storehouse containing commodities to be used by future generations; a reservoir for water; a protector of soil, streams and plants; a home for animals and birds; and a playground to which human beings may retire when they grow tired of an artificial world.[4]

Forestry. Forestry is the science, art, and business of managing forest lands for the continuous production of forest goods and services.[5]

Conservation. The word "conservation" comes from the Latin language and means "to save, to protect, to preserve or care for; to guard or keep safe in an entire state." It also means the wise use of natural resources and stoppage of waste.[6] Conservation means the preservation of the native wildlife of an area, both as to the abundance and as to the

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[4] Charles N. Elliot, Conservation of American Resources (Atlanta: Turner E. Smith and Company, 1940), p. 233.

[5] United States Department of Agriculture, Trees, Yearbook of Agriculture 1949 (Washington: United States Government Printing Office, 1949), p. 656.

[6] Garrard Harris, Elements of Conservation (Richmond: Johnson Publishing Company, 1924), p. 1.

natural balance between species in as nearly its virgin condition as possible, in view of the requirements of agriculture and other necessary human uses of the land.

Natural resources. A resource is "that to which one resorts or on which one depends for supply or support," therefore natural resources are those materials supplied by nature which are useful to mankind.[7]

III. SCOPE OF STUDY

The scope of this study is restricted to students of Alamance High School, Guilford County, North Carolina, who were enrolled in biology during the school year 1952 and 1953.

The literature to be reviewed will cover the history and present situations of the forests including the use of the forest, the enemies of the forests, and conservation of forest.

The projects to be discussed and reviewed will be only those projects carried out by the above mentioned group. These projects will consume only a part of the school year and will supplement the biology program. They will not replace any vital part of the program, but will be carried out along with the botany phase of the program of approximately six weeks duration.

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[7] Elliot, op. cit., p. 10.

IV. SOURCES OF DATA

The data for this study were collected from three sources: (1) pertinent books and literature dealing with the subject, (2) actual work experiences involving students, and (3) films and teaching aids distributed by private and governmental agencies.

Books and literature as a source of data. The books and literature were used in obtaining an overall picture of the importance of forestry and the history and present status. These books were from the Appalachian State Teachers College Library; Superintendent of Documents, United States Government Printing Office, Washington 25, District of Columbia; and Extension Service, State College Station, Raleigh, North Carolina. Some of the most helpful books were: Charles N. Elliot's Conservation of American Resources; A. F. Gustafson and others' Conservation in the United States; A. E. Perkins and Whitaker's Our Natural Resources and Their Conservation; George T. Renner's Conservation of Natural Resources; and Trees, Yearbook of Agriculture 1949. The most important bulletins were Mattoon's and Shinn's Forestry For 4-H Clubs and Charles Randall's and Marie Heisley's Our Forest: What They Are and What They Mean to Us. Much of the literature is repetitious but these above proved most valuable.

Students and work experiences as a source of data. In the 1952-1953 biology class there were thirty-six students enrolled. These students carried out the projects included in this study. From the work of the students, recommendations were made for future studies of this type. It is not necessary to go into the studies at this point as they are covered in a following chapter in detail.

Films and teaching aids as a source of data. These sources were used to help determine the types of projects to be carried out by the students. From these sources ideas were drawn to be used in the study with the students participating.

V. SUMMARY

In this chapter the problem has been stated, the terms defined, the scope of study and sources of data given.

The remaining chapters deal with the history of our forests, the present status, enemies and needs. In this section the need for forest conservation is shown. Projects which were carried out dealing with forestry are described in a single chapter. From the projects listed, a chapter is included which gives recommendations to teachers. These recommendations cover methods and materials to be used.

CHAPTER II

REVIEW OF LITERATURE HISTORY AND PRESENT SITUATIONS

I. HISTORY

When the earliest settlers came to our country they found forests covering about forty eight per cent of the land, and this forest portion was divided into two broad belts -- one inland from the Atlantic Ocean to the Mississippi River and beyond and the other inland from the Pacific to the Rockies. The eastern forests covered highlands and lowlands alike, whereas the western forests were and still are interrupted by many areas of non-forested lands. Evergreen and deciduous trees, with deciduous predominant, are found in the east, but in the west the trees are mostly coniferous because of the relatively dry summers.[1] In no other area of the world was there so vast a forest with so large a number of highly useful trees because more than 100 of the 500 kinds were found to be economically useful.[2] From those earliest times, the forests have played a most important part because they furnished materials for the first homes, first weapons, fuel, furniture, maple sugar, dyes, plank

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[1] A. E. Parkins and J. R. Whitaker, Our Natural Resources and Their Conservation (New York: John Wiley and Sons, Inc., 1936), p. 238.

[2] George Bush, Dickie Allen, and Ronald Runkle, A Biology of Familar Things (New York: American Book Company, 1939), p. 557.

roads, ship materials, and the naval stores. Many other uses were made of the wood, but for generations the American farmers fought the forests by clearing the land, then burning it or allowing the wood to rot. Today there is only about one eighth of the virgin timber left and 85 per cent of our forests are gone.[3]

II. TOPOGRAPHY AND FOREST REGIONS

Various types of forests are found over the United States, the kind depending on location, climate, and soil. Most localities have plenty of evergreens because they were growing on earth before oaks, Maples, and the rest of the broad-leaved varieties; therefore they had more time to get themselves scattered over the world. These trees are mostly cone-bearers or conifers and grow where other types fail. A large part of their endurence lies in the nature and structure of their leaves because they can somehow make food in the various climates. On better drained, richer soils, in warmer climates particularly, the evergreens are giving way to the broadleaf hardwoods, also called deciduous trees; that is trees that drop their leaves in the fall. They are usually faster-growing than evergreens and can be recognized by their leaves, flowers, fruit, bark, buds and tree form.[4]

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[3] George T. Renner, Conservation of Natural Resources (New York: John Wiley and Sons Incorporated, 1942), p. 114.

[4] Bush, Allan, and Rumkle, op. cit., p. 568.

At present about 59 per cent of the total area of North Carolina is covered with forests, making more than 18,000,000 acres of forest lands.[5] Originally there were vast resources of both hard and soft woods -- the oak-hickory forest, the oak-chestnut-yellow poplar, and extensive oak-pine -- but most prominent has been the yellow pine. In this state we find trees of various types because the state reaches from the highest mountains in the eastern United States to the coastal plains along the ocean.

North Carolina has three regions -- the southern Appalachian mountains, the Piedmont plateau, and the coastal plains. In the mountains are found the highest peaks and the greatest rainfall east of the Rockies. Climate is mild, and the soil is usually thin and gravelly on ridges and high slopes with lower slopes having deeper and finer soil, the best soil being in the coves. The forest types are southern hardwoods from the piedmont to certain elevations depending upon the latitude, then white pine (which does not climax here), then northern hardwoods, with spruce and Fraser fir on the highest peaks. In the hundred and twenty-five-mile-wide Piedmont plateau the surface is gently rolling with residual soil formed from disintegration of the underlying igneous and metamorphic rocks. For the most part it is a deep gravelly red

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[5] Wade Lucas, North Carolina Is Giving Much Attention to Conserving Forest (Greensboro: Greensboro Daily News, July 6, 1952).

or gray clay. It supports a hardwood forest, mostly hickories and oaks. Red gum and short leaf pine are also found. The piedmont is largely an agricultural region so the forests are mostly confined to farm wood lots. The last region is the coastal plain with its fertile strips along the rivers called "hardwood bottoms," swamps and sandy ridges. The pinelands are on the ridges, the hardwoods on the silt river banks, and the cypress and gums in the swamps.[6] The pinelands have longleaf, shortleaf, loblolley and slash pines with some southern red, turkey, black, post, laurel, and willow oaks.[7]

The two types of ownership of forests are public and private. The public includes federal, state, county and municipal. They own 20 per cent of the commercial timber, while the private owners have 80 per cent. These include properties of corporations, industries, and individuals. The non-commercial timber includes parks, reservations, sanctuaries, and scrubby and inaccessible timber not qualified for timber production but valuable in protecting watersheds, controlling soil erosion, and providing cover and food for wildlife. In the character of the commercial forest growth we find five

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[6] Edward G. Cheyney, American Silvics and Silviculture (Minneapolis: University of Minnesota Press, 1942), p. 68-80.

[7] Wilbur R. Mattoon, Forest Trees and Forest Regions of the United States (Washington: Department of Agriculture, 1940), p. 43.

groups: (1) virgin forests, (2) areas cut over but coming into second growth of saw timber, (3) areas cut over but now producing trees of cordwood size, (4) areas recently cut over with seedlings for future growth, and (5) areas so badly cut or burned over that they are being restocked. Although the south has 38.7 per cent of the commercial forest area only 12 per cent of it is saw timber.[8]

II. USE OF FORESTS

Source of materials. The forests as a source of materials has ranked high since colonial times. Many early structures are still standing as a tribute to the enduring and valuable quality of wood as a construction material. Wood is one of the world's most useful raw materials because it provides man with shelter, food, clothing, and a wide variety of implements; helps transportation with railroad ties and boats; furnishes poles for communications; furnishes props for mine tunnels; and gives wood pulp for paper. Industries that furnish such products as rayon, baskets, barrels, veneer, turpentine and rosin depend on the forests. Maple sugar is gotten from the maples and tannin for the leather industry is furnished by oaks and hemlocks. One half of the

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[8] A. F. Gustafson and others, Conservation in the United States (Ithaca: Comstock Publishing Company, 1939), p. 182.

timber cut today goes into lumber, one fourth into fuel, and the remaining for other uses.[9] Most of the products used by the American people, whether vegetable, animal, or mineral, have required wood somewhere in the process of production, distribution, or utilization.

Protective influence. Forests furnish protective influence over several of our resources. The first one is air, because forests and plants in general take in carbon dioxide and give off oxygen which men and animals must have. Many areas of forest provide windbreaks to protect other areas. Soil is the second resource depending on forests. They prevent erosion, stop landslides or snowslides, and help keep sand dunes from shifting. They also help keep moisture in the soil and provide material to enrich the soil. Closely related to the soil comes water. The standing forests render an invaluable service in protecting the water supply. Thick canopies of tree tops break the fall of rain and force of wind. When rain or snow reaches the forest floor it sinks slowly into the absorbing soil and gradually finds its way to springs and streams. This slow handling of rainfall tends to make streams flow regularly and continuously throughout the year.[10] The gradual evaporation of water through the stomata of the leaves cools

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[9] Ibid., p. 164.

[10] Bush, Allan, and Rumkle, op. cit., p. 558.

the atmosphere and this tends to precipitate the moisture in the air, causing rains. The rainfall is greater and more regular in forested areas. This adequate watershed protection insures an abundance of water for use in homes, for irrigation of cultivated lands, for river navigation, and for power for electricity.[11]

This protection of water and soil helps in the protection of wildlife. Rich moist soil will grow plants that wildlife needs for food and protection. The fresh silt-free water goes into the streams and lakes throughout the year to provide homes and food for fish and other forms of aquatic life. This water life, in turn, furnishes food for animals that live along the water ways. Forests furnish sanctuaries for birds and animals, thereby reducing damage from insects and rodents, which furnish food for the birds. Larger animals, such as the deer and the elk, have found our forest refuges the only place where they can keep from becoming extinct. All of these natural resources are interrelated, and one cannot survive without the other.

Relationship to agriculture. The two principal uses of land are for forests and for agriculture; therefore their interrelation is vital to national welfare. Agriculture draws

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[11] George W. Hunter, Problems in Biology (New York: American Book Company, 1949), p. 575.

heavily on forests for its products, such as materials for buildings, posts, fuel, containers, and equipment. Farm water and soil are helped by forests. Often the farm income can be supplemented by winter employment in woods or wood-using industries or in the sale of wood gotten by selective cutting. In North Carolina there are thousands of acres of oak, gum, ash, maple, birch, beech, and sycamore left by the woodcutter years ago that can be contributing to the economy of the state. Also the wealth of hardwood species, favorable soil and climate will reforest cutover tracts with merchantable timber.[12] Reforestation will make unproductive farm land profitable. It is estimated that one half of the forest lands supply pasturage for grazing animals. Grazing should be done only in large areas by the right number of cattle. Forestry increases farm income in the following ways: (1) Makes use of waste land, (2) furnishes winter employment, (3) furnishes wood products needed on the farm or to be sold, and (4) increases crop yield by protection of soil and water.[13]

Recreational benefits. Besides serving us in these other ways, the forests offer recreation and pleasure for both

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[12] Charles Crockett, Hardwood Trees Hold Unreaped Wealth (Greensboro: Greensboro Daily News, June 14, 1953).

[13] Wilbur R. Mattoon, Forestry and Farm Income (Washington: United States Department of Agriculture, 1940), p. 32.

young and old. The forest is an ideal camping place, hiking area, and place for picnics and excursions. In certain areas at designated times hunting is allowed and the streams offer much pleasure to the fisherman. The beauty, the atmosphere of peace and quiet, and glimpses of wildlife appeal to many people. Many national, state and municipal parks have been established, and thousands visit here each year.

Forests have a higher and wider mission than merely to supply wood. The forests, lakes, streams, mountains, and fertile valleys all belong together. Without them there would be little of human happiness or aspiration left. To preserve them even the hard road will not seem too hard.[14]

IV. ENEMIES

Man. Although the forests have several enemies, man has done the worse damage through unwise use and fire. He first started by clearing the land for cultivation and destroyed much of the wood by burning it or leaving it as waste. Many farmers still practice this destruction. Man wastes lumber in every step from the forest to the finished product. The lumber industry is a saga of waste shown by the following: (1) high stumps left, (2) clean cutting, (3) young trees

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[14] Richard Lieber, America's Natural Wealth (New York: Harper and Brothers, 1942), p. 181.

destroyed in logging, (4) less desirable species thrown away, (5) no seed trees left, (6) slash left as a fire hazard, and (7) cutover land grazed, causing the undercover of grass and last remaining seedlings to be destroyed.[15] There have also been ruinous and destructive methods used in the extraction of naval stores.

Although lightning causes a few fires, at least 90 per cent of them are caused by man. In the following table are shown the ways fires began and their percentages in the south:

Incendiary	30.56%
Smokers	16.51%
Debris burning	14.44%
Campers	8.82%
Lumbering	6.62%
Railroads	5.17%
Lightning	1.10%
Others	16.78%

(This was taken from "A National Plan For American Forestry" Volume II, p. 1404.)

Each year there is about six per cent of the total forest area burned over and each year much of the same area is burned again. The damage caused by fire can be listed as follows: (1) waste of valuable timber by destroying it or cutting down yield from surviving trees, (2) destruction of young trees and plants, (3) retarding of growth of remaining trees by stunting or furnishing fire scars for points of

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[15] Renner, op. cit., p. 114.

attack that fungi and insects use, (4) killing of wildlife, (5) depriving game of shelter, (6) increase of soil erosion, (7) starting destructive floods, (8) contributing to irregular stream flow, (9) sapping soil fertility, (10) marring the beauty of the landscape, (11) reducing recreation areas, and (12) endangering human life.[16] Fortunately two thirds of the fire losses are preventable; therefore society must make every effort to prevent them from starting and when started, control and suppress them.

Insects. Insects are an enemy that is hard to control because damage is so far advanced before discovered. Some of the most destructive insects are the bark beetles, the gypsy moth and the brown tail moth, the spruce budworm, the white pine weevil, and the locust borer. They can be controlled to some extent by proper methods of forest management and the introduction of insect parasites. Birds and mammals are also useful in control.[17]

Disease. Another enemy difficult to control and appraise is disease. Two that have caused much damage are the chestnut-bark disease which has ravaged the native chestnut, and the white pine blister rust. The latter can be

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[16] Elliot, op. cit., p. 254.

[17] Gustafson, and others, op. cit., p. 200.

controlled to some extent by destroying the currants and gooseberries near the pines, because the spores are produced on the leaves of these plants. Disease cannot be controlled unless we prevent the conditions which make it possible for disease to attack trees and develop. This means the growing of healthy trees, the elimination of forest fires, eradication measures and quarantine where feasible.

Animals. Animals grazing in woods can do serious damage to both the mature trees and the young growth. The older trees can be injured by having their roots trampled and by having the soil around them compacted to such an extent it is nearly impervious to water. Young growth is often entirely destroyed. Cattle, horses, sheep, and young goats feed on young seedlings, particularly the hardwoods, also trample on brush against them, causing them to break. Hogs eat the seed of certain trees and prevent new growth, or root pine seedlings out of the ground to eat the inner bark. Grazing in woodlands should be carefully regulated if the stand is to remain productive.[18] Deer have caused some damage in areas where they are crowded. Beaver dams kill trees in flooded areas and rodents harm immature growth. Damage from wildlife is so little that it would be counteracted when the natural resources are balanced.

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[18] Randall and Heisley, op. cit., p. 86.

Weather. In some localities windstorms have caused extensive damage. Snow and sleet may be harmful to young or weak trees in loading them to the breaking point or deforming them. Mainteining our forest in as good a condition as possible is the only defense against bad weather.[19]

At the present our forests will last only thirty to forty years, but fortunately measures are being taken.

V. CONSERVATION

History. As early as 1681 ordinances were passed to conserve forests. Then William Penn required that one acre in every five that were cleared should be left in trees. The states passed ordinances before the nation. In 1777, North Carolina, and in 1787, South Carolina enacted laws against willful and careless woods burning. First action by the national government was in 1799 and in 1827 when laws were passed to conserve the supply of live oak timber for the navy. These remained in force until 1831. Then it wasn't until late in the nineteenth century that further action was taken. In 1875 the American Forestry Association was organized to promote the principles of forestry. In 1891 Congress passed the act allowing the president to withdraw forest lands from public domain and the first forest reserve withdrawn was the Yellowstone National Park Timber-

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[19] Ibid., p. 26.

land Reserve. In 1896 more land was withdrawn and progress made in administrating it. It was not until Theodore Roosevelt became president in 1901 that citizens of America became conscious of the fact that our natural resources were not inexhaustable. In 1904 the foresters and the forest reserves were put under the jurisdiction of the Department of Agriculture. Gifford Pinchot became the first chief of the forest service. The civilian conservation corps was established to restore natural resources and the soil conservation service to aid the farmers of the nation in saving our resources. Laws have been passed and new associations devoted to conservation have been formed. Today there are at least twenty federal agencies dealing with forest conservation policies and practices. Forty-two states have forestry agencies.[20] Many colleges and universities maintain forestry departments. Conservation is also emphasized by Boy and Girl Scouts, Camp Fire Girls, 4-H Clubs, General Federation of Woman's Clubs, The Garden Club of America, and others.

Needs. It is essential to the nation's well-being that our present activities in the field of forest conservation be expanded and vigorously pushed forward. The following practices are needed:

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[20] Elliot, op. cit., p. 37-49.

1. Remaining timber supplies should be conserved and used wisely.
2. Inferior woodlands should be improved.
3. Idle and non-productive land should be restored to forest growth.
4. Adequate fire protection must be provided.
5. Insects and destructive animals must be controlled as much as possible.
6. Lumber companies must practice conservation.
7. An educational program must be set up to instruct all succeeding generations in the need for forest conservation.

All of these needs are possible of being fulfilled because the forest is a renewable resource. Yet the problems of forest conservation are extremely complex and will be solved only through positive action based on thorough understanding of their social, economic, and biologic relationship.[21]

Methods. Conservation methods may include the following:

1. Protection from fire -- This means educating the people to realize the danger of fire. When near woods they must practice good forest manners at all times. This means

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[21] Bush, Allan and Runkle, op. cit., p. 565.

seeing that all matches, cigarettes, and cigars go out; that the campfire sparks are dead; that brush or slash is not burned in windy, dry weather; and that when fires do start, an up-to-date fire fighting organization is ready. A good fire-fighting organization will have lookout towers, men on duty twenty-four hours a day during fire season, a map of the region, a strong pair of field glasses, and a telephone to notify the ranger. The ranger should have helpers he can get quickly, equipment to use for fighting, and fire roads or trails whereby to gain access to the fire.

2. Conservative logging -- This can be done by loggers' leaving no high stumps, being sure there are seed trees, disposing of the slash, not doing clean cutting, and reforesting non-restocking areas.

3. Elimination of destructive methods in turpentine industry so that the naval stores can be gotten but the trees will remain alive.

4. Better practices in wood industries -- This will include efficient milling, industrial utilization of wood waste, use of wood preservatives and use of substitutes for wood.

5. Increase in public ownership -- Too many private owners exploit the forests, thinking only about making as much money as possible at the present. A few are realizing the need for conservation, but those lands kept under public ownership serve many purposes.

6. Practice of forestry -- The purpose of this is to obtain from forest lands and their products the greatest economic, industrial, and human benefits. One way of accomplishing this is through sustained-yield forestry, that is, cutting timber equal to the amount grown during the same period on all remaining trees. The south is destined to lead in this; because it contains about two fifths of the forest land, tree growth is rapid, flatness makes for easy logging, the region is strategically located with regard to the more important markets, and saw-log production can be carried out along side other ventures -- grazing, thinning for poles, turpenting and paper making. Many farm woodlands are under some form of sustained-yield organization.[22]

7. Encouragement and education of the public to demand and support conservation in all ways. In North Carolina forestry education has come a long way since the first United States school to offer professional forestry instruction was opened on the Vanderbilt Estate near Asheville in 1898. This was discontinued in 1913, but North Carolina State College at Raleigh began instruction in forestry in 1929. Today there is also a school of forestry at Duke University, which is one of the two schools in the United States to offer the professional Doctor of Forestry degree.

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[22] Perkins and Whitaker, op. cit., p. 277.

Through the division of forestry of the North Carolina Department of Conservation and Development and the forestry extension division at State College, the state is constantly sending or taking the message of better forestry to the people who live in its one hundred counties. This cooperative program has proved to be a good one and has produced excellent results from a forestry standpoint.[23]

VI. SUMMARY

Since our forests are so very important but have been reduced so very fast leaving only fifteen per cent, there is a great need for action. North Carolina with its great variety of trees across the state has great opportunities to develop them, but the work will have to be done by both public and private owners. Even the small woodlands on the farms require attention. Each person must realize the value of the forests for materials, protection, aid to agriculture, and recreation. Then he must fight the enemies as man and unwise use, insects, disease, animals, and weather. By conservation of our forests the public will eventually increase that fifteen per cent and benefit humanity.

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[23] Lucas, op. cit.

CHAPTER III

METHODS AND PROJECTS UNDERTAKEN BY AUTHOR AND STUDENTS

I. LOCATION AND GROUP

The projects were conducted at Alamance High School and neighboring community in Guilford County. The land is rolling and fertile, crossed by numerous streams at an elevation between 800 and 900 feet above sea level. The climate is mild with rainfall usually evenly distributed throughout the year. The land is almost evenly divided between land under cultivation and woodlands, 52% being under cultivation.[1]

Alamance High School is situated on a thirty-seven acre tract and has access to approximately twenty-five acres adjoining. Permission was received from the owner of a neighboring farm to use his wooded area and bottom land. This provided abandoned fields, woods, cutover areas, and streams. See Figure I on page 27.

The group that carried out these projects was the sophomore biology class consisting of thirty six members.

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[1] Guilford County Board of Commissioners, Guilford County North Carolina: Agriculture (Greensboro: Guilford County Board of Commissioners), p. 2.

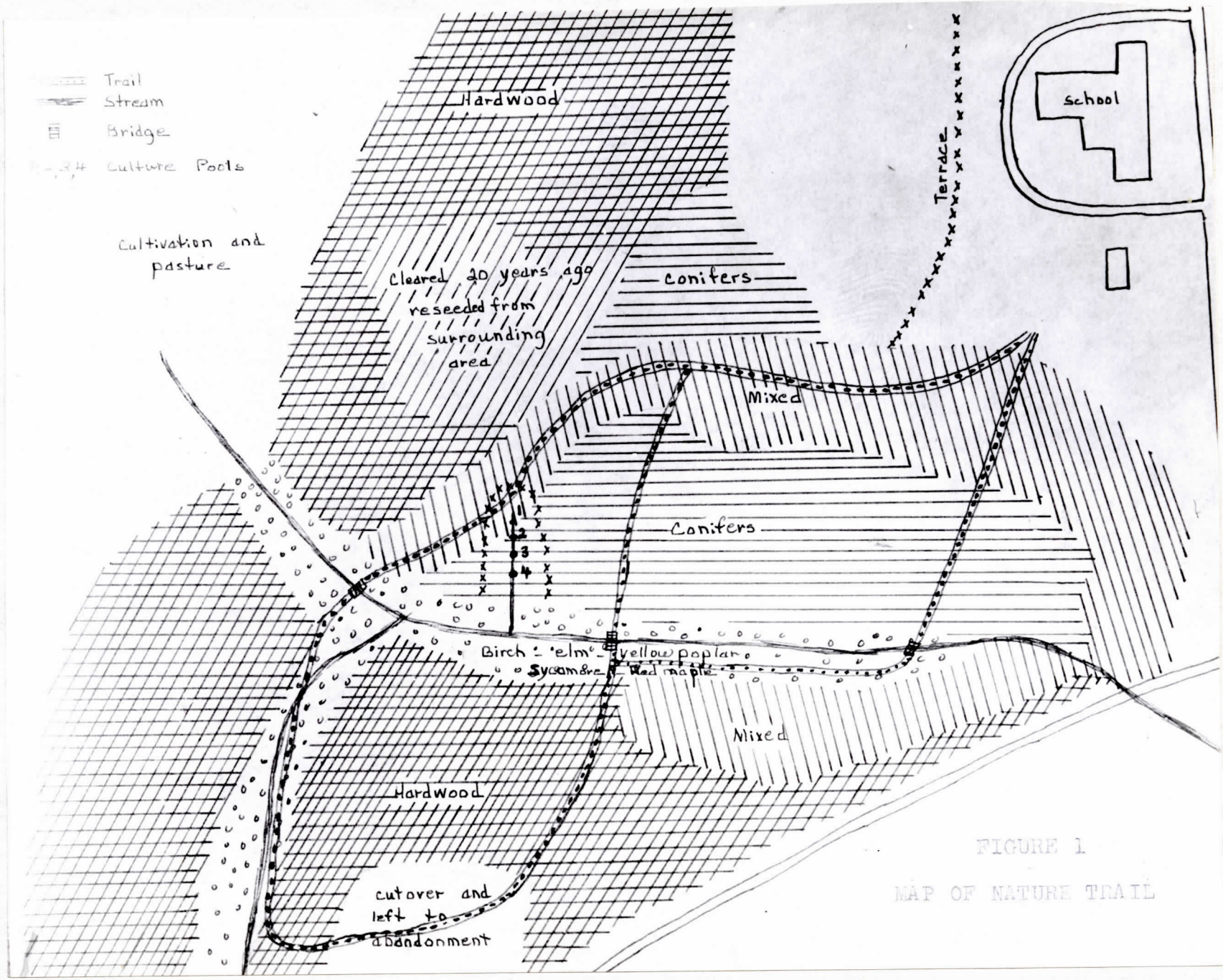

FIGURE 1

MAP OF NATURE TRAIL

The class was taught general science by the author the previous year. During the course in general science, conservation was stressed. Knowing the chief interest of the group was conservation of forest, the author made a list of forestry projects during the summer of 1952.

II. PROJECTS DEVELOPED

As an introduction to the topic of forestry, the students were given assignments dealing with the subject of forestry. The subjects dealt with such topics as conservation of forestry, poor lumber practices, forest fires, duties of the county forester (the forester came to our school and explained these), importance of the forests, present and past status of forests, effects of cutting down the forests, and the demands of the nation from the forests. The textbook was used as a general reference for growth of plants but it was supplemented by other material given in Chapter Two. Some films were carefully selected and shown. Each film was chosen for a particular study and shown prior to that study or project. For a list of suitable films see the appendix. Student reports were given and lectures were given by the teacher. It was felt that this was time well spent in getting the class interested to carry out the following projects.

Surveys. The students and teacher, having decided upon forestry as the chief topic for fall and spring, made plans to survey the community. These were surveys to determine the various types of seed trees, sawmills of the area, land to be reforested, trees in general, good forest practices, and poor forest practices. These surveys were carried out by individual students in their own locations and they reported to the class on what they found. Choosing the more promising areas, the author made personal visits to these to learn the possibilities of each for a teaching unit. Having conducted nature study trips in the area for five years, the possibilities of the school grounds and the adjoining farmlands were known to the author.

Choosing several of the better students, a survey of the school area and adjoining tract was made during an activity period. It was decided that this area was very suitable for a nature trail, because many plants, including trees were present and the area in general well suited for nature study. Another point in favor was the accessibility of the area and nearness to the school. The students reported to the class at the next meeting and the class voted to set up a nature trail. As this was early fall, the class under direction of the teacher decided to map out a trail. From the science room window, six acres were pointed out to the

group. Using the students who made the initial survey as group leaders, the class was divided into smaller groups of approximately six students to a group, putting boys and girls into separate groups. The manual tasks were assigned to the groups of boys. To these fell the task of building a terrace around the only fresh water spring in the entire area. (It should be pointed out here that the greater part of this project and succeeding projects were carried out in approximately six weeks all total using the laboratory periods and activity periods, the group being under the personal supervision of the instructor or group leader at all times.) Another task for the boys was the construction of three culture pools along the spring stream which they had previously terraced. Bridge building (lashing of cedars together with raw-hide and some nails--the cedars already felled in the process of plant sucession, having lost the battle of survival of the fittest) was another task assigned to the boy groups because there were three crossings of streams. The girls' groups mapped out the trail so that it would pass the places of interest that were best adaptable for our study. Here they needed close supervision in order that the trail would pass several of each of the various tree species found in the area as well as take in the cut-over land, eroded and abandoned land, and as many different

types of habitats as possible; because the trail was being planned not only for the study of trees, but other plants and general nature study as well.

The rough trail was set up and then some markers were set up temporarily. Each group worked in its respected section of the trail until the trail was completed--under the supervision of the instructor. Permanent markers were then erected. These were made by the students at home from a standard set by the group. They were constructed of slabs sixteen inches long and approximately eight to ten inches wide with two foot stake on each end. Another slab of matching dimensions was used to cover this and was fastened to the base slab by raw-hide leather. Below is an illustration of a marker.

FIGURE 11

NATURE TRAIL MARKER

How the Nature Trail was used. The trail proved most beneficial for later studies conducted along its route. It was used not only by the science department of the high school, but by the grammar grades as well. The Brownies and Intermediate Girl Scouts used it in their studies of tree identifications and wildlife. The time spent in setting up the trail paid off with huge dividends in creating an interest in nature study. Many teachers began using the trail with their grades, who had previously remained in the classroom. Each school should have a trail, if at all possible. See Figure 3 for scenes of use.

a. Tree and Leaf Identification. With the trail completed, our second project began. The trail was used for the study and identification of trees in the early fall, when the leaves are mature. The best place to study any part of nature is in its natural environment, the great outdoors laboratory. The trees were studied from various standpoints. We noticed the overall signs of trees in comparison to other types, the bark, the limb and twig arrangements, the canopy, the general shape of the tree, fruit, seeds, and the leaves. In this study we dealt only with the common names of the trees as the instructor believed the scientific names are too advanced in such a study. The more important kinds of forest trees were stressed. A

study was made of the two main types -- the conifers or tree bearing cones such as the cedar and pine; (In this group also are spruces, firs, hemlocks, junipers, larches, tamarack, and cypress -- all evergreen except cypress, larch and tamarack) and the hardwoods most of which have wood harder than the conifers, broad leaves, and are usually deciduous, that it they shed their leaves in the fall. It was pointed out in the discussion that some hardwoods are evergreens--two of these are the live oak and holly. For this study one of the best manuals to use is Common Forest Trees of North Carolina prepared by J. S. Holmes, state forester; published by the North Carolina Department of Conservation and Development, Raleigh, North Carolina; and available for ten cents a copy.

b. Special projects of leaf and fruit collections. The group made these collections and noted the size, shape, and structure of leaves as well as the fruit types. Groups of girls with a great susceptibility to poison oak and ivy made leaf spatter prints and also leaf ink prints, using green printer's ink. These prints were used to a good advantage for room decoration as well as keeping before the students the leaves of various trees.

c. Distribution of trees. While the groups were becoming acquainted with trees, they also learned that pines

are found in the dry areas, usually higher up than the hardwoods. They noted also that the birches are found along the bottoms by the stream along with willows and elms. The oaks are found on higher ground. A deep discussion of plant succession and associations is not, in the opinion of the author, advisable for high school students. It was pointed out that certain trees require more moisture and better soils than others and that there is a continual struggle between types and individuals for light, soil, and water.

To sum up this project, a practical test was given on identification of trees and an evaluation was made of the collections of the individual students. The interest during this project remained very high. The author felt that was due not only to the fact of being something different but because of an actual interest in the subject. The students gave of time and materials and put their mental and physical abilities to work. The students thought this a wonderful experience.

A. Forest Planting

B. Testing Day

C. Bridge

D. Tree Identification

FIGURE 3

SCENES ALONG NATURE TRAIL

Forest Reproduction. This project was decided upon in the fall. The students of general science class had a project in the laboratory. The project was the study of seed germination using vegetable seed. The biology class saw it and asked if they could do one like it using seeds from trees. We talked over the possibilities of such a project and several students said that they had collected seeds during the spring course of general science and had added to it in the summer. When asked "why?" they stated that their elder brother, sister, or friend had told them it was required in biology. We set up several objectives: (1) to determine if the seeds would germinate, (2) to study the adaptations of seed for dispersal, and (3) to study the types of seed.

In carrying out this project, seeds were used which the class had collected the previous spring, summer and that fall. Maple seeds were used for the winged type; apple and peach seeds for the pulpy fruit type, and acorns were used for the nut kernels. Because no seed were found in the cones, which were brought in by the students, no gymnosperms were used. These seeds were planted in a mixture of sand and mulchy loam soil, then placed in a laboratory window, which is located on the southwest corner of the building. There, they were exposed to the sun and to the heat from the building. They were carefully tended and watered until the seed sprouted.

From the collection were obtained maple sprouts and one apple. Some of the seeds were removed in order to check the germination of seeds in the various stages of development. Poor germination was found, but the project was even more successful that the author had anticipated. Several students took cuttings from a willow and buried these in a moist place along the stream bank and these were more successful than the seed project.

Not only were seeds and cuttings planted, but from the seeds brought in by the students a seed collection was made. This was divided into four groups: those carried by animals, those carried by birds, those carried by water, and those carried by wind. In the animal group was placed hickory, walnut, oak and persimmon. In the bird group was placed cedar and cherry. In the water group was placed willow and maple and in the wind group sycamore, willow, elm, catalpa, and maple. It should be understood many others can be used, if they are available.

During a field trip the students observed the numerous sprouts rising from the stumps of sweet gum trees.

This project was done aside from the regular classroom work. The students took an active part in planting the seeds, carrying for them and making individual collections. It aided them also in recognizing various trees from which seed were

collected. They enjoyed watching the growth of plants and tending to their own plants. It was a project that they could watch daily and it gave them responsibilities. The project had served a valuable purpose in getting across to the students the reproduction of plants and trees from seeds and sprouts, and also the various means and agencies for seed dispersal.

How a tree grows. This project was done in the spring in connection with springtime biology. After studying the units on leaves, stems, and roots, the class was taken to a nearby sawmill. The purposes of this field trip were: (1) to familiarize the students in the use of an auger, (2) to show how a tree grows, (3) to notice the influence of environment upon the trees, (4) to show the sections of stems, and (4) to see the actual cutting and sawing process. The agriculture teacher accompanied the group along with the instructor. The trip was for the agriculture boys as well as the biology class. It was carried out by the use of an auger to drill holes in the trees. The core that was removed determined the age and rate of growth. The students took turns at counting the rings removed by the auger and also at drilling the trees. The students also counted the annual rings of trees at various levels on the tree. This was easily done as a sawmill was working this stand and the tree trunks were cut in convenient

lengths for this study. It was noted that the higher the log on the tree, the younger that section was. The group did the same procedure with limbs and branches cut from the timber.

While on this trip, the agriculture teacher and instructor pointed out to the group in the remaining timber the effect of crowding among the trees. The students being familiar with the leaves, stems, and roots began the discussion of the importance of air, light, soil, and water. We moved into the forest which had not been cut and there, they pointed out trees which were growing tall seeking the light, trees that were small because others had crowded them out, and trees which were dead and dying, not from disease but from crowded conditions. The agriculture teacher told the group that a forest without small trees was not desirable because there was nothing coming in to replace the older trees.

The next day, as our trip took two periods, a short true-false test was given on the age of various parts of the tree, how the limbs grew above the ground, and as to whether or not a limb actually grew higher as the trunk grew higher.

Forest Planting. This project was worked on during a six year plan by the agriculture students. The entire area of the former school grounds, which was used as a play

area, was badly eroded. Their main purpose was to stop erosion, but they also started timber for the future. Loblolly pine seedlings were ordered through the county forester. They were set out by the students under the supervision of the vocational agriculture teacher. The plantings were started in the late winter and early spring of 1947-48 and continued through the school year of 1952-53. Each year one section was planted and the older areas replanted where needed. Now the total available area of approximately six acres is planted; therefore providing a potential timber crop and stopping erosion.

Several of the science and biology classes were invited to watch the methods used. The area, being approximately two-tenths of a mile from the new school plant, gave the classes a chance to observe the work of the agriculture boys. In projects of this nature the science department and agriculture department try to cooperate to avoid duplications of effort. The classes have studied this area and have shown a keen interest in the various growth areas and the area in general because they had played in this area during their earlier school days.

Protection by the Forests. This project was set up to study the actual benefits derived from the forest and was done in the spring. As it covered such a broad field, the

students and teacher decided to make it into two projects. These were entitled "Protection by the Forests" and "Products of the Forests." Protection by the forest was stressed in three areas: (1) classroom experiments and bulletin board, (2) nature trail, and (3) school ground bordering the wooded area.

In the classroom a bulletin board was assigned to the biology class on which was placed any article dealing with floods, droughts, extinction of wildlife and any other related topic. These articles were discussed in class and the articles kept before all the high school students enrolled in science courses.

An experiment was conducted with samples of soil taken from the deep woods, the ball field, and a road bank. The soils were placed in kerosene lamp globes which were purchased from a local hardware store. (Incidentally, they are very inexpensive.) A cloth and filter paper were placed over the bottom of each globe and then the globes were set up in large fruit juice cans. Measured equal volumes of water were poured into each globe. It was found that the globe containing the soil and litter from the wooded area let the water flow through while the other two globes hardly had one-half depth penetration. The conclusion from this experiment was that the wooded area served as a reservoir. This is true because

the water falling on these areas does not run off into streams but remains in the soil and litter to be slowly released into the streams.

On the school ground bordering the wooded area two sections of galvanized gutter of equal lengths were buried in the soil with the open part at ground level. One was buried in a sparsely grassed area and the other in a wooded area. The sites were of the approximate same slope. After the next hard rain, the gutters were checked. Much soil and debris had washed into the gutter in the open, while the one in the wooded area had only a few fine particles of decomposing leaves in it. They saw first hand the value of trees for checking erosion and holding soil. This experiment was repeated several times with practically the same results--especially after a severe downpour.

In this same location the students noted a large degree of difference in comfort between the wooded area and the open area. They placed a sign on the trail leading into the woods which said "10° cooler inside and air-conditioned." Other signs were placed by the students along the nature trail to show protection by the forests as: "Whose field is this?" in soil washed in the stream, "Apartment for rent" near a hollow tree, "Penthouse, above" on a tree containing a nest. These signs showed that the teaching had not been in vain and the students were keen observers, who enjoyed

their work. Even though the signs may seem to some as being out of place, they show that the students were thinking of the protection received from the forests and the benefits as well.

This project gave the students first hand information which will stay with them much longer than something read. The fact that they had a part in planning and developing this project impressed the benefits even more upon their minds.

Products of the forests. This project was carried out as a survey project and was a cooperative undertaking with the civics class. Many of the biology students were also enrolled in the civics class at the time the survey was made. The purpose of this project was to teach the students to find and use resource material in addition to learning the products of the forests. The first thing done was making accessible to the students, in the resource section of the science room library, all materials available at the school dealing with forest products.

Materials were ordered from the United States Forest Service, Southern Region, Glenn Building, Atlanta 3, Georgia. One help proving most beneficial in this survey was a wall poster entitled "What We Get From Trees," Number M-5293. A special order blank can be secured from the Forestry Service listing all bulletins dealing with forestry. Teachers are requested to order from these blanks and not the pupils.

Another valuable aid was "A Compilation of Farm Forestry Publications of United States Department of Agriculture," which was compiled for the county agents of North Carolina by the Forest Service, United States Department of Agriculture, in cooperation with the North Carolina Agriculture Extension Service. This compilation was secured from the Guilford county farm agent who was very cooperative in the survey.

Information was secured from the State Forester, 204 State Education Building, Raleigh, North Carolina. Another valuable aid was the Yearbook of Agriculture, 1949, entitled "Trees." From this was obtained the address of the Forest Products Laboratory, Madison 5, Wisconsin. A postcard to this laboratory will send information on most any forest product or else a referral to another source that can supply the information.

Simply upon the request of a student to an employer of the local Dupont Point Company, a deluge of information came in. The Dupont Company has excellent material on wood products. Some of these deal with the story behind such products as turpentine, resins, alcohols, cellulose products, plastics, and rayon. These are especially helpful in many other courses besides this study.

From the audio-visual materials, the students developed in the library (serving as the classroom for civics) a wall

display. This drawing was centered with a student's drawing of a tree and from the various parts of the tree (trunk, roots, bark, etc.) were streamers of ribbon. At the end of each ribbon was an actual sample of products from that area of the tree or a small picture cut out from a magazine. This proved to be a very colorful and educational project.

The class was taken on a trip into Greensboro to see one of the largest cedar products companies in the world, The Brown Cedar Plant. They saw the cedar brought in, graded and sawed to certain dimensions for different manufacturers and the manufacture of cedar oil. On the trip, the group visited a hardwood dimension shop. The wood being used was dogwood. They saw it cut into dimensions to be used in the manufacture of shuttles for textile mills. The company does not manufacture the shuttle, but the group was shown a shuttle which had been made from dogwood.

The group, on another occasion, was taken through the Brooks Lumber Company, which is one of the city's largest. There they saw the chief products of the forest used in building. Not only did they see the products, but the types of wood were identified for them by the plant foreman. One interesting part of this project was the wood collection that was made from samples given the students.

This project was carried out as a research problem more than a demonstration project. The students did a wonderful

piece of research and the interest of the group was high. The foundation had been made for such a project in the classroom teaching and their other experiences with forestry projects.

These projects dealt with one particular group of students. In the future the nature of such projects will be determined by the interests of the group, the school, and location of other groups.

CHAPTER IV

RECOMMENDED METHODS AND MATERIALS

I. RESULT DEMONSTRATION

This type of demonstration is conducted by the teacher to show locally the value of a recommended practice. Result type demonstrations will be best taught on field trips to show good practices such as where trees have been cut selectively, using the mature trees, but leaving the young trees and not harming the undercover (in this area there can be noted the different sizes of trees of the same age as a result of differences in growing space); pastures that have been forced out of the woodland to prevent overgrazing; eroded or unproductive land that has been restocked with trees; a fire-tower and other fire fighting equipment; a lumber products plant that shows good utilization of the wood; and a national or state forest to exemplify the protective influence. Poor practices can also be shown on field trips: areas that sawmills have left in ruin, areas that have been burned over, pastures containing woodlands, unproductive and eroded areas where trees have been cut, and areas where insects or diseases have entered because of poor care.

II. METHOD DEMONSTRATION

A method demonstration is given by the teacher for the purpose of showing how to carry out a practice. Where the school ground is sufficient, get seedlings from the state forestry department and plant an idle area; use a woodlot to show selective cutting; and demonstrate in connection with the projects the students have such as leaf collections, forest reproduction, and products made from wood. These demonstrations will depend on the local community resources. Resource visitors and vocational agriculture teachers will be helpful demonstrators.

III. SUPPLEMENTARY MATERIALS

The text that is used in the school with reference books available in the classroom or library will give information. One of the best groups of supplementary material is the bulletins issued by the United States Department of Agriculture, the North Carolina Resources Commission, the North Carolina Department of Conservation, and the United States Forests Products Industries.

IV. EXHIBITS

Though their direct teaching influence may not be large, exhibits are informative, attract attention, stimulate

interest, and create good will. If the exhibit emphasizes one idea rather than many, its value will be greater. The person who sees an exhibit will observe his own surroundings a little more closely, perhaps, and awareness and beginnings of appreciation are implanted. Perhaps the exhibit will stimulate the viewer to ask for more information on forest conservation. If he does, it is a good exhibit. The primary use of exhibits is to stimulate interest. Students can help put them on by collecting materials from local wood product industries. Aid can also be gotten from the "School Bibliography--Our Forests--Their Use and Conservation" published by the American Forest Products Industries, Inc., 1319 Eighteenth Street, N. W., Washington 6, D. C.

V. COLLECTIONS

These collections can be of the actual leaves, blossoms, and fruit, or prints can be made of the leaves. The students can collect them at their homes or on field trips. Sometimes the process is mechanical, yet the leaves they happen to be preserving are handled several times and must be labeled correctly; therefore this becomes a teaching device. Such a collection is an effective way of developing close observation as well as manual dexterity in handling fragile things.

VI. VISUAL AIDS

Photographs tell a grephic story so they are an excellent supplement to the spoken word. Other visual aids are maps, graphs, and charts. Some of the most effective aids are slides or motion pictures. All these aids will help much in teaching forestry and conservation, but must be used at the right time to correspond with the discussion.[1]

VII. RESOURCE VISITORS

People who are trained in forestry and conservation may be asked to visit the classroom, give talks, lead discussions, or conduct some of the field trips showing result demonstrations or method demonstrations. Some of those asked can be foresters, soil conservation workers, county farm agents, and other specialists in forestry and forestry products. Students who have carried out 4-H, F. F. A. and Scout forestry conservation projects can also offer valuable information.

VIII. PROJECTS FOR STUDENTS

An advantage claimed for the project method is that it gives a better understanding of subject matter and develops a better plan of reasoning. When supervising students and

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[1] Ruth Lohmann, Teaching Conservation of Wildlife Through 4-H Clubs (Washington: United States Department of Agriculture, 1938), p. 21

their projects there are several objectives to remember in this subject as in other science subjects. A teacher should:

1. Consider needs and interests of learner,
2. keep material on level of learner,
3. have objectives that serve as guides to selection and organization of learning materials, and
4. keep the subject and work functional.

With these objectives in mind a teacher should plan for these units by making a survey of the immediate and neighborhood surroundings in order to list all available materials and situations. Such a survey will familiarize the teacher with their location and avenues of approach as well as special features and the purposes they will serve. Several exploratory expeditions are required. When the survey is made with the aid of a supervising official, it becomes a more worthwhile venture.

The number of journeys and trips will depend upon the importance of the materials and the relationship to the curriculum and the needs of the pupils. Projects on or near the school plant can be conducted in the regular recitation period, if it is some distance, special arrangements should be made.

Before students start their projects and make their field trips, there are several rules to remember for both the teacher and the students.

The following are recommended for teachers:

1. Learn and evaluate any advantages to be received from the project to be undertaken.
2. Determine the purpose or purposes of the field trip or journey.
3. Examine the survey data, secured earlier, for proper materials and concepts.
4. Make any necessary arrangements with school authorities and owners or operators of places to be visited.
5. Stress the needs of trip in class and get the students enthused.
6. Let them help with planning the trip and fix specific goals or aims.
7. Do not try to teach too many things on one trip.
8. Arrange the trip so that too much time will not be needed for travel.
9. List the needed materials and check to see that the pupils have them. Some suggested materials are notebook and pencil, proper clothing, first aid kit, reference books or materials, and a definite desire to make the trip.
10. By all means the teacher should be thoroughly familiar with the area or situation to be studied.

11. Make a previous trip to the area and be familiar with the place, the route, special places of interest, and reference materials.
12. Let the students know beforehand what is expected of them and follow-up the trip with classroom discussion and tests.

A student should:

1. Familiarize himself with the purposes of the trip.
2. Study and plan for the trip. The more a student puts in planning and studying, the more he will understand what he sees when he gets there and the more he brings back with him.
3. Remember he is a member of a group and not the whole group.
4. Be thoughtful of others.
5. Be courteous, attentive, and alert.
6. Not dominate the trip.
7. Let the leader lead and should not lag or straggle.
8. Ask relevant questions and take notes.
9. Show appreciation to the guide for the time and trouble.
10. Be prepared to summarize the trip for classroom discussion.

If the teacher and students follow these rules, both will find the projects and trips successful.

The projects below are not intended to be complete in all details but they are intended to be suggestions from which one may plan his own. Forestry is much too large a field to be covered completely in just a few projects or pages, nevertheless, there must be something done to create interest in forestry among our citizens. These projects may serve as mere starting places -- where they will lead remains to be seen.

1. Leaf collections and tree identifications. A good project for students in learning forest trees and forest types is collections. Bulletins from the State Forestry Department and colleges will be beneficial. Encourage the students to get materials. An excellent booklet for identifications is J. S. Holme's, "Common Forest Trees of North Carolina," put out by the State Department of Conservation. Here too they can use the state and federal foresters and agricultural leaders, because they are ready to help identify leaves, fruits, buds, and woods. For illustrative materials, use the woods, as they are the best material to be found. If it is impossible to go to the woods, use representative pictures of typical trees. The teacher should be well acquainted with the trees in his area and where possible do the

following: have the students learn the names of the various common trees; distinguish the different species of trees by some well-marked characteristics of leaf, bark, fruit, seeds, buds, or twig arrangement; study the different types of trees which are associated in different forest types, such as ridge type, slope or cove type, bottomland type, and swamp type; observe locally the trees that are associated to make (1) coniferous forest type, (2) pure hardwood type, and (3) mixed hardwood and conifer type; gather leaves and fruit of the important local trees, press in paper, fold and label with place and date; make a study of buds with drawings of the buds and twig arrangements; and collect some blossoms from trees, such as red and silver maples, willows, catalpa, American elm, oaks, dogwood, tulip tree (yellow poplar), and magnolia.

In the woods the teacher and the student will come in personal contact with the trees. Identify your trees by leaf, fruit, buds, bark, branches, or flowers. The teacher should have good lead questions, and by all means should have made a previous visit to the area for the purpose of his own education, to help in explanations and identifications for the group. While getting acquainted with trees, one will learn that they prefer certain localities. The willows will be found near the streams, poplars (yellow) in or near the

valleys and white and black oaks on higher ground, because one requires more water in its soil while another grows in a drier situation. You will find that certain trees "buddy" together because of similar requirements of soil, moisture, and light. In this way a student will learn to group his trees into forest types for future use in conservation, planting or harvesting.

After finishing this project students should be able to recognize at sight the chief forest types of the locality. On the following page is a list of trees found in Guilford County. Many of the same trees will be found throughout the piedmont section and some in the coastal or mountain sections of North Carolina.

2. Surveys. To acquaint the students with forestry in their community or the surrounding area, have them to make surveys of the forests as to the types and number of acres, and note the type of care which they are getting from the owner. Make surveys to determine the amount of reforestation in the locality. Check for poor pasture practices, for example, where forests are in pasture. List fields on farms where planting should be done. Survey for usable timber and for any areas needing firebreaks. Not only will this type of project make the students more conscious of their surroundings but it will also help them meet people, give them first-hand information, and make them more "conservation-minded."

COMMON NAME	SCIENTIFIC NAME
White ash	Fraxinus Americana
River or Red birch	Betula nigra
Blackgum	Nyssa sylcatica
Crabapple	Malus angustifolia
Dogwood	Cornus florida
American elm	Ulmus Americana
Winged elm	Ulmus alata
Shagbark hickory	Carya ovata
White hickory	Carya tomentosa
Holly	Ilex opaca
Honeylocust	Gleditsia triacanthos
Red maple	Acer rubrum
Red mulberry	Morus rubra
Black oak	Quercus velutina
Post oak	Quercus stellata
Red oak (southern)	Quercus falcata
Spanish oak	Quercus coccinea
White oak	Quercus alba
Persimmon	Deospyros virginiana
Shortleaf pine	Pinus echinata
Virginia pine	Pinus virginiana
Redbud	Cercis canadensis
Red cedar	Juniperus virginiana
Sassafras	Sassafras albidum
Sweet gum (Red gum)	Liquidambar styraciflua
Sycamore	Plantanus occidentalis
Umbrella tree	Magnolia tripetala
Black walnut	Juglans nigra
Black willow	Salix nigra
Yellow poplar (Tulip tree)	Liriodendron tulipifera

FIGURE 4

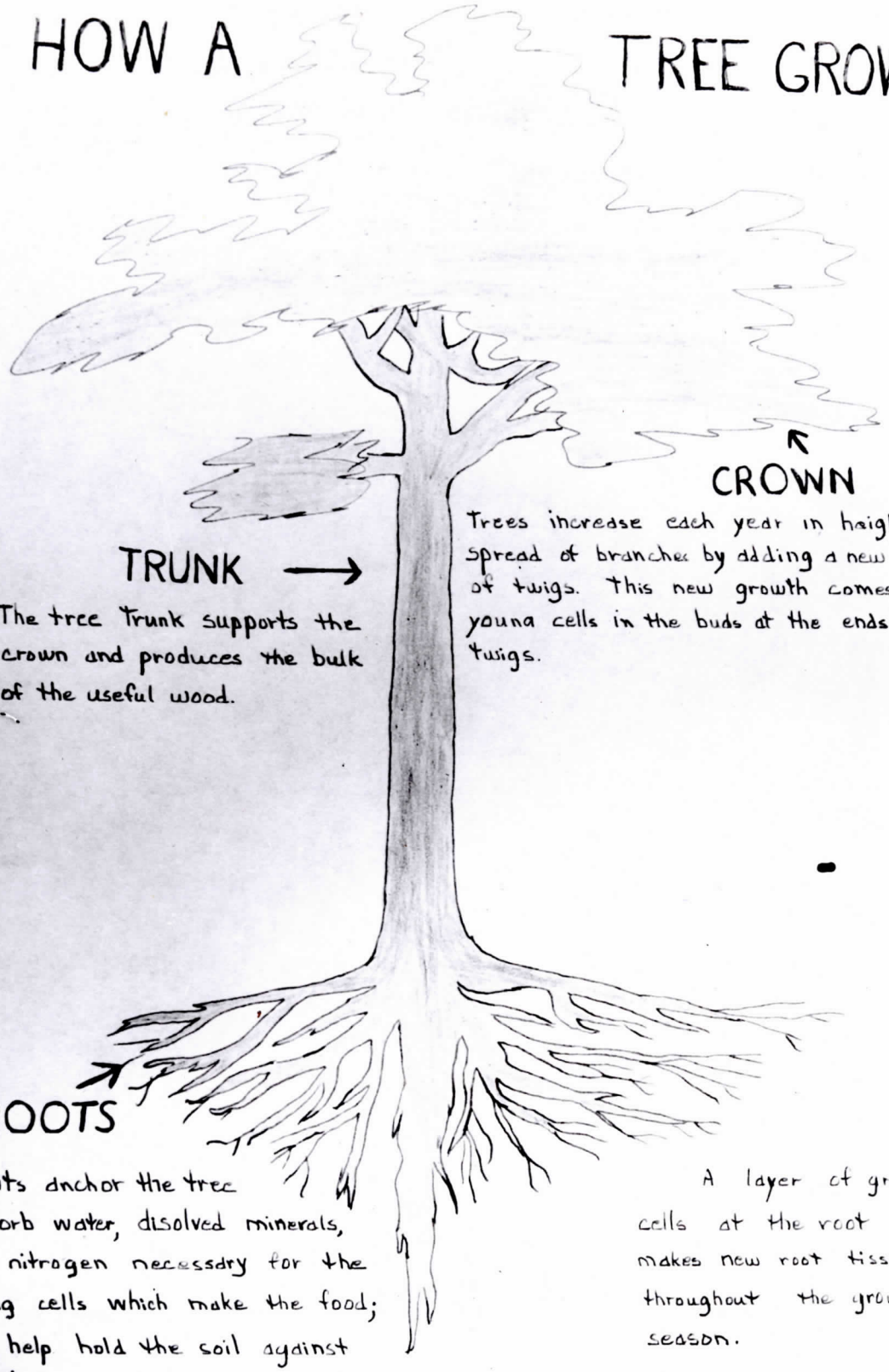
TREES ALONG NATURE TRAIL -- GUILFORD COUNTY

3. Growth of trees. Some good bulletins to help with this project are Farmers' Bulletins Numbers 1256, 1486, 1517, 1571 and Miscellaneous Publications 182. These can be obtained from the Superintendent of Documents, Washington.

In the study of trees' growth, charts are needed (similar to the ones on the following pages) showing roots, stems, leaves, and cross sections of the wood; and showing different parts such as annual rings, heartwood, sapwood, bark, and cambium. The cambium is where all growth takes place, between the inner bark and the sapwood. Slides showing tree growth and cross sections of the trunks are excellent materials to help. These will help show the function of each part of the tree, how the tree breathes and gets its food from the soil and air, what travels upward and what downward in the branches, the leaf structure, and the different parts of the trunk. In observing the trees notice also how the limbs lengthen and the diameter increases.

Stress requirements of growth: air, light, moisture, heat and food. Create interest through the following questions: How old is the tree from which the cross section was taken? What influence do trees have on one another? What are the influences of light, crowding, shading, overstocked stands, understocked stands, and well-stocked stands? Place a plant or seedling in light and another in shade for several days.

HOW A TREE GROWS



CROWN

Trees increase each year in height and spread of branches by adding a new growth of twigs. This new growth comes from young cells in the buds at the ends of the twigs.

TRUNK

The tree trunk supports the crown and produces the bulk of the useful wood.

ROOTS

Roots anchor the tree absorb water, dissolved minerals, and nitrogen necessary for the living cells which make the food; and help hold the soil against erosion.

A layer of growth cells at the root tips makes new root tissue throughout the growing season.

FIGURE 5

HOW A TREE GROWS

HOW A TREE GROWS

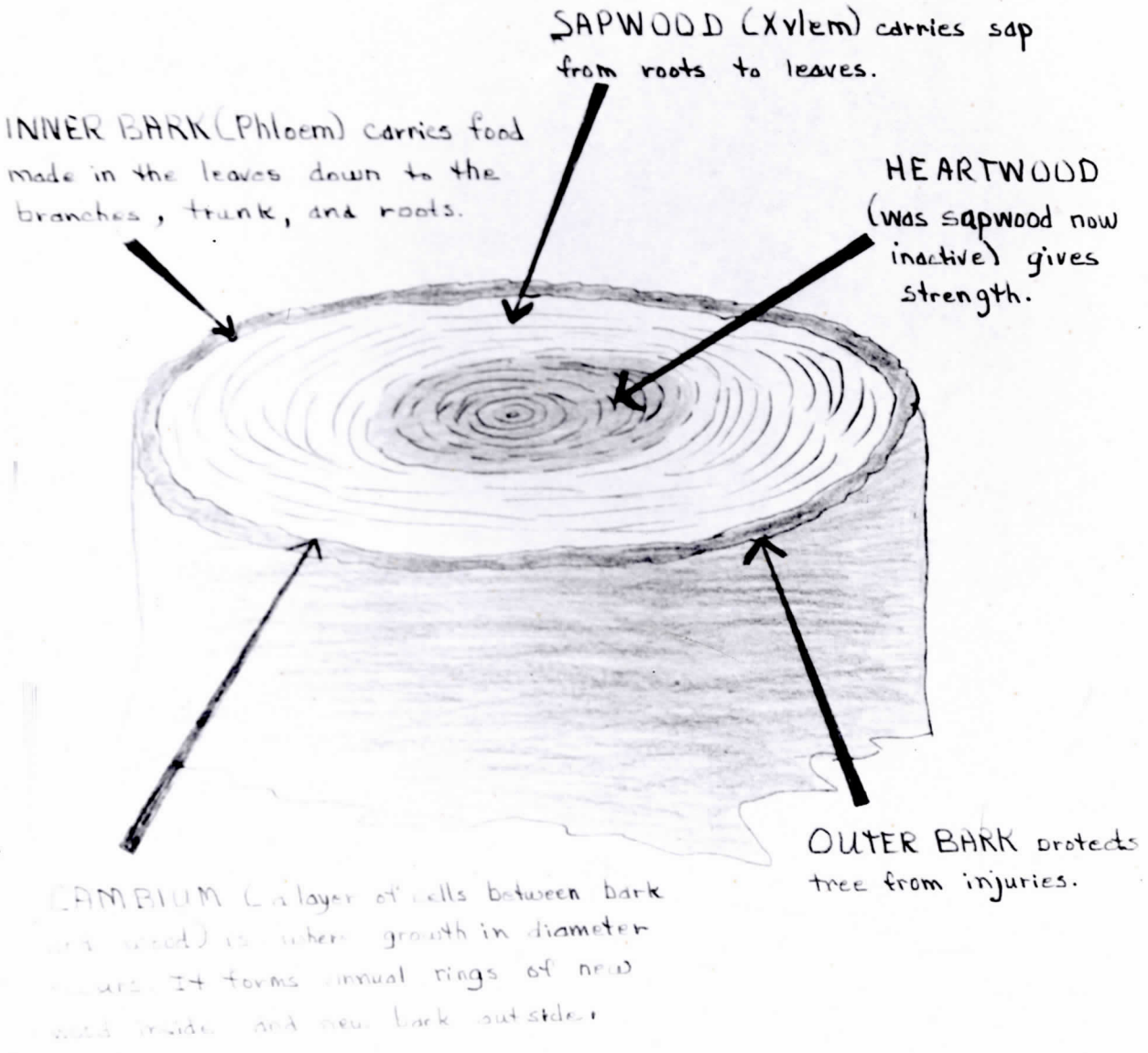


FIGURE 6

HOW A TREE GROWS

PHOTOSYNTHESIS. Leaves are the most important chemical factories in the world. Without their basic product, sugar, there would be no food for man or animal, no wood for shelter, no humus for soil, no coal for fuel.

Inside each leaf, millions of green-colored microscopic "synthetic chemists" (chloroplasts) manufacture sugar. They trap radiant energy from sunlight for power. Their raw materials are carbon dioxide from the air and water from the soil. Oxygen, a by-product is released. This fundamental energy-storing, sugar-making process is called photosynthesis.

What happens to this leaf-made sugar in a tree? With the aid of "chemical specialists" (enzymes), every living cell--from root tips to crown tips--goes to work on the sugar. New products result. Each enzyme does a certain job, working with split-second timing and in harmony with the others. In general, they break down sugar and recombine it with nitrogen and minerals to form other substances.

ENZYMES. Change some sugar to other foods such as starches, fats, oils, and proteins; which help form fruit, nuts, and seeds.

Convert some sugar to cell-wall substances such as cellulose, wood and bark.

Make some of the sugar into other substances which find special uses in industry. Some of these are rosin and turpentine from southern pines; syrup from maples; chewing gum from chicle trees and spruces; tannin from hemlocks, oaks, and chestnuts.

Use some of the sugar directly for energy in the growing parts of the tree--its buds, cambium layer and root tips.

TRANSPIRATION. Transpiration is the release of water vapor from living plants. Most of it occurs through the pores (stomates) on the underside of the leaves. Air also passes in and out.

FIGURE 7

HOW A TREE GROWS

1. RULE FOR MARKING -- cut no more than has grown during the year, take out the diseased or crowded or limby trees first, then make up the rest of the year's cut from the more mature, better trees.

2. RULE FOR CUTTING -- cut each marked tree into the product for which it is best suited on the available markets. Most of the larger trees go into sawlogs; smaller trees and tops of large trees make pulpwood; large post oaks make fence posts, and low-grade rough hardwood are made into fire-wood.

3. RULE FOR CARE -- "Forgotten Acres" are caused by fire, which destroys or damages the wood; livestock, which eats young growth and harms the old; and poor cutting, which does not provide for tomorrow's harvest. Fire control, livestock kept out of woodlands, and proper cutting will insure a future timber crop.

FIGURE 8

RULES FOR GROWING TIMBER CROPS

What happens? Why? Give one moisture and exclude moisture from another. Note results. If possible, subject plants to different degrees of heat.

Have students erect poles by the same type of tree seedlings at various places where the conditions for growth are different. Let them record the growth rate by marks on the poles, which are placed there at regular intervals of two to three weeks. With this, you can also bring in weather and how it influences the growth as well as do soils, water, or moisture.

4. How Forests Reproduce. An excellent bulletin for this project is Miscellaneous Publication 162, "Our Forests: What They Are and What They Mean To Us."

Have students make a seed collection of the specimens of trees found in your locality. Mount these or place them in wide mouth bottles. From the seeds learn the various devices of nature for dispersing the seed widely. Study the tree fruits (a) with wings, plumes, etc.; (b) pulpy fruits with hard seeds sought by the birds; (c) rich nut kernels liked by rodents and birds, and often buried or stored away; (d) light seeds that float on the surface of water or heavy seeds that roll along the bottom of streams. Learn the species of trees whose seeds are carried by (a) wind, (b) water, or (c) birds and animals. Study those trees that produce or

reproduce by means of sprouts from stumps and note what part of the stump produces the sprouts, and those trees that produce from surface or lateral roots. Discuss the influence of the season of the year on sprouting or pruning and the influence of the age of the parent tree.

A teacher should point out the conditions which are necessary for young growth to start in woodlands. "A forest without young growth is like a community without children -- it will die out."[2] Stress the need for a large number of young trees for the continuance of the forest. This can be met in part by leaving two or three seed trees per acre when cutting trees for lumber. The rule of survival of the fittest can be shown by pointing out the death of weaker seedlings and saplings. There are various age groups in young growth to notice: (a) seedling, (b) small sapling, (c) large sapling, and (d) small pole.

5. Forest planting. (Methods demonstration)

The publications that will offer reference for this project are Miscellaneous Publication 357; Farmers' Bulletins numbers 1256, 1405, 1492, 1517 and 1813; and Leaflets 155, 156 and 159. From these bulletins can be obtained the various methods of planting seedlings. Here also is an opportunity to ask the guidance of a resource visitor such as the forester, the soil conservationist, or the county farm agent. Let them

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[2] Mattoon and Shinn, Forestry for 4-H Clubs (Washington: Department of Agriculture, 1941), p. 11.

help decide the more important trees to use and what types will do the best in that area which you intend to plant.

Seeds can be collected locally by the students and these can be planted. If this is not practicable, seedlings may be obtained through the agriculture teacher or the forester. Preparation of the soil is important. This project can be done jointly by the science and the vocational agriculture departments. Besides properly preparing the soil, one must do it in the proper season in the right way. In steep and eroded areas choose trees that will check erosion and soil wastage quickly. Locust and pine are two types of seedlings used often in North Carolina.

If this project cannot be carried out on the school ground, try to locate an area or section that you can plant or where you can observe planting. Visit your farmers or county agents; they can give you good examples for result demonstrations; if not for methods demonstration.

Be sure your trips are not mere excursions from the classroom. See that they are learning experiences.

After the trees are planted, carry out proper methods for the care and protection of them. This is as important as seeing that they are properly planted.

6. Protection from the forests. It is very important to stress and to let the students find out how the forests

or woods conserve soil moisture, check soil erosion, and modify temperature. Bulletins that will help on this project are Farmers' bulletins numbers 1405, 1757, 1813, and Miscellaneous Publications 162, 196, and 247.

Here, again, the best illustrative materials will be found on a trip to the woods and fields. If a trip is not practical, get illustrations from papers and magazines showing erosion on unprotected hillsides and the use of trees for shade and shelter. Point out the way in which a forest cover conserves the water from rainfall or melting snow. In a trip to the hills and fields, students can learn, by actual observation, the bond between the forests and waterways. When they leave the open and enter the cool shade of the woods, they will notice the forest affects temperature. The floor of the forest can be observed with its undergrowth of young trees and shrubs, the ferns and moss, and the litter of fallen leaves. Have students dig in the floor to see (a) the layer of twigs and leaves, (b) the spongy layer of decomposed vegetable matter or humus, (c) the lower layer of soil interlaced with the roots, and (d) the subsoil. How does this control water? Find a spring and ask, "Why is water flowing from the spring?" This is where the rain water or melted snow from the hidden reservoir is seeping out and into the streams to furnish a steady supply of water for the

pastures, farms, mills, power-plants of the city, and the city itself. A good lead for this could be a flood--either local or distant--or a water shortage similar to the one felt in most of North Carolina in the spring and summer of 1952, and again in 1953. Another lead would be the dust in the air, which is not too uncommon in this state. These points can be emphasized: Why is the dust in the air? Who is to blame for the dust storms? What holds the soil in the forested areas? How do forests prevent wind and erosion?

Return to the open. There have pupils dig in the soils and notice how dry and hard they are. Why? What happens when it rains on this type of soil? Let them see for themselves by actual observations on the school ground play areas. What happens to the drainage system when a heavy rain falls? Why do we have floods? Important facts to note in this soil are: depth, why it is shallow, where it went, and places where it can be seen as muddy bottoms on streams and lakes or sandbars in streams.

Another protective device of the forest is the shelter, flood and cover which it supplies to our wildlife. This is important as all science teachers know. You could branch from here into the food chains and ecological factors.

The boy or girl who has been very observing and taken part in the project will begin to see the relation which the forests of the country bear to the land.

7. Products of the forest. (Survey) This project could be used in science teaching, civics, sociology, and economics. It will take much research on the student's part. They can take advantage of information given in the following: Farmer's bulletins 1310, 1356, 1366, 1480 and 1756; Leaflets 29 and 133; and Miscellaneous Publications 162 and 247. Students can write the leading industries of wood products for any illustrative materials they have. (Following pages contain charts that can be used.)

Have the students make a survey or study to discover the chief use of wood in their district. What other wood products are made or used here? What trees furnish the most desired wood? Are there any sawmills nearby? Where is the lumber going? Use the furniture factories or any other lumber industry which may be nearby for field trips. After making their survey, they should make a list of forest products and tell the use of each commercially. On the basis of the survey, decide which trees are more important or desirable.

The preceeding project suggestions are neither intended or expected to meet all the needs of all teachers in every locality or situation. Teachers are encouraged to combine or to select parts of these mentioned to meet their own individual needs and adapt them to their own situation. The

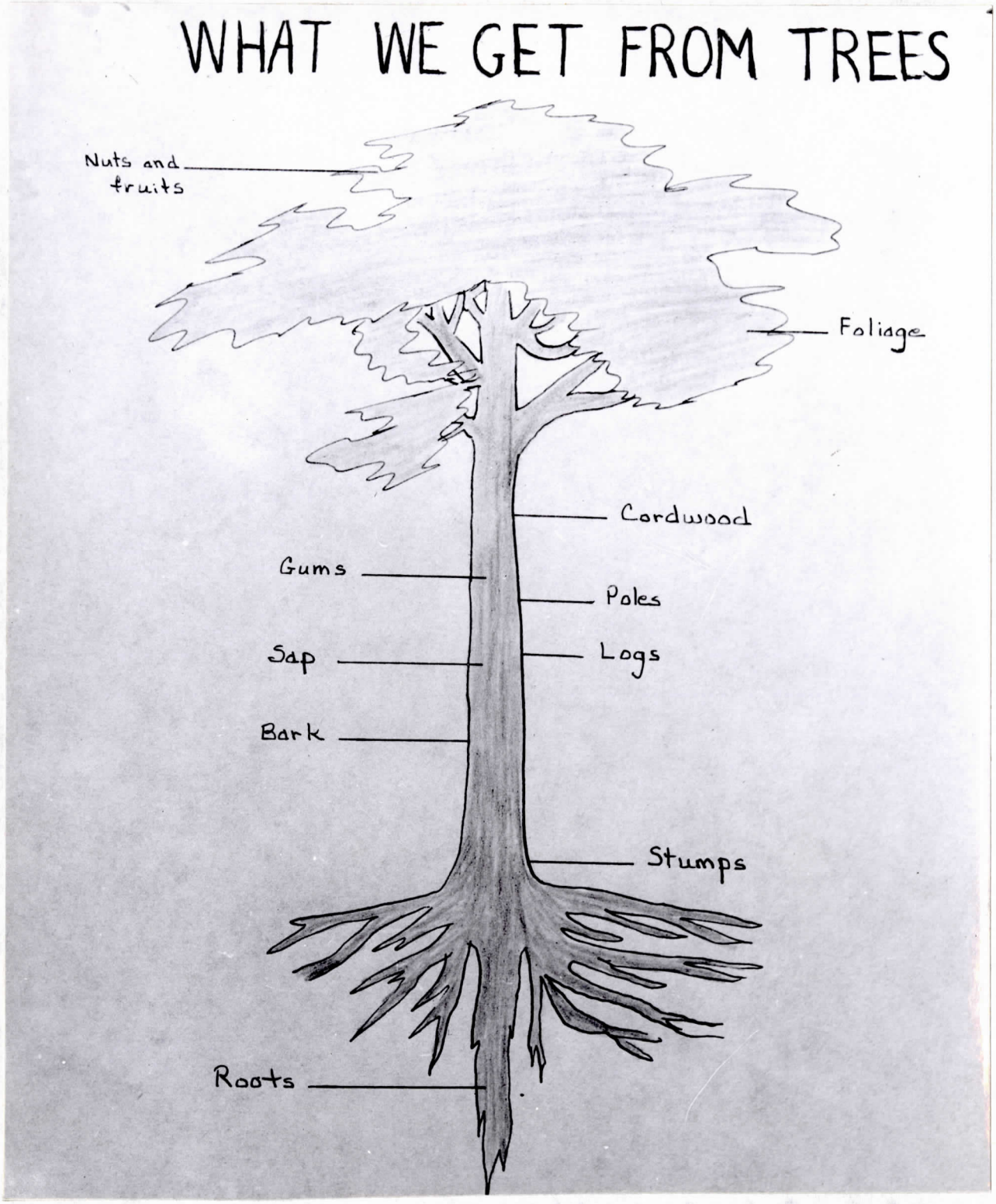

FIGURE 9

WHAT WE GET FROM TREES

FIGURE 10

WHAT WE GET FROM TREES

1. Nuts and Fruits
   - Walnuts
   - Hickory nuts
   - Butternuts
   - Chestnuts
   - Pecans
   - Acrons
   - Chinquapins
   - Pinon nuts
   - Hazelnuts
   - Persimmon
   - Mulberry
   - Black cherry
   - Paw paw
   - Crab apple
   - Wild plum
   - Serviceberry
   - Elderberry

2. Foliage
   - Oils
   - Decorations
   - Extract

3. Gums
   - Storax
     - Drugs
     - Incense
     - Adhesives
     - Perfumes
     - Flavoring extracts
   - Heptane
     - Drugs
     - Measure for gasoline knock
   - gum rosin
     - varnishes
     - drugs
     - paint dryer
     - greases
     - shoe polish
     - roofing materials, etc.
   - Resins
   - gum turpentine
     - paints, varnishes, stains
     - furniture polish
     - waterproof cement
     - drugs
     - greases
     - crayons
     - soaps
     - explosives
     - insecticides etc.
   - Balsam
     - drugs
     - adhesives
     - spirit varnishes
     - bottle sealer and glass cement
   - Spruce gum
     - drugs
     - chewing gum
     - confections

FIGURE 10 (continued)

4. Poles, Piles and Posts

Fuel

Charcoal

5. Cordwood

Pulpwood

- lignin
  - road building materials
  - plastics
  - fertilizer
  - vanilla
  - tanning materials
- cellulose
  - Chemical Products
    - Rayon
    - Cellophane
    - Explosives
    - Alcohol
    - Photo film
    - etc.
  - Fiber Products
    - Paper
    - Pulp and paper products
    - Wall boards

Dye

Excelsior

Distillation
- Hardwoods
  - charcoal
  - acetate of lime
  - wood creosote
  - tar
  - acetic acid
  - wood alcohol
- Softwood -- oils

6. Sap
   - Sugar and sirup
   - Sirup blend

7. Bark
   - Tannin
   - Drugs
   - Oils
   - Dye

FIGURE 10 (continued)

8. Logs	Manufacture	farm implements	
		boot and shoe findings	
		boxes	
		caskets and coffins	
		dowels	
		firearms	
		fixtures	
		furniture	
		handles	
		matches, etc.	
	Lumber	rough construction	
		subflooring	
		shingles	
		planning mill products	
		flooring	
		paneling	
		general millwork	
		window and door frames	
		mantels, stairs and cabinets	
	Veneer	baskets	
		furniture	
		plywood	
		fixtures	
		shipping containers	
	Bolts	handles	
		barrel staves	
		shingles	
	Timbers	beams	sills
		posts	joists
		columns	stringers
	Waste	slabs	insulation
		trimmings	ceramic tile
		edgings	fuel
		sawdust	
	Ties	cross switch	
	Veneer	wood rosin and turpentine	
		charcoal	
9. Stump		pitch	
	Distallation	wood tar	
		tar and pine oils	
10. Roots	Smoking pipes		
	Tea and oil		

author realizes that all communities do not have forest areas convenient for study, however, many of the projects can be carried out in most any locality, whether it is urban or rural.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The problem of this investigation was to review and investigate some literature with its implications that might be used in a forestry program for secondary schools of North Carolina. The fessibility of such a program was to be determined by carrying out some actual work units in the biology class and on the basis of this work, make recommendations concerning various methods, materials and techniques that may be used in secondary schools. In this final chapter are presented brief summary of the problem, a review of projects completed, major findings, statements of conclusions, and recommendations.

A statement of the problem, its major aspects, and the importance of the study are presented in Chapter I. The underlying purposes of the study, also presented in first chapter, were to carry out a teaching program at Alamance High School in which to create among the students of biology an understanding of the importance of forests and to provide data upon which could be based a teaching program with recommended materials and methods.

In Chapter II a brief history and the present situations of forests were given. Included in this chapter were topography

and forest regions, uses of the forests, enemies of the forests and conservation of forests.

Chapter III gave the location of the study, the group doing the study, and write ups of the actual projects were included. These projects included the building of a nature trail, surveys conducted by the students and teacher, the growth of trees, forest reproduction, forest planting, the protection from forests and products of the forests.

Chapter IV deals wholly with methods and materials that can be used by a teacher in setting up and carrying out a program of teaching forestry conservation in a secondary school.

Based on the actual study presented in Chapter III, the findings of this study are as follows:

1. Regarding materials and methods. The best type of method is the project method as it is best liked by the students. Not only did they enjoy them, but it gave the students a better understanding of the subject and a chance to develop their creativeness and resourcefulness. Collections were valuable, because the materials were handled several times, and this enabled the student to become better acquainted with the materials. The best sources of materials are the bulletins published by the United States Department of Agriculture, Holmes' Common Forest Trees of North Carolina, and the community resources and industries. The nature trail

was by far the greatest asset, furnishing both materials and methods.

2. Regarding student reaction and participation. The students agreed that projects afford them first hand learning situations which they preferred over classroom discussions and textbooks. An appreciation of the forest was instilled in the group because of this type instruction and the nature of the experiments dealing with the subject. All students participated to the fullest. These projects helped develop leadership among the students. Students in this study worked harder on these projects than on other courses that utilized only a textbook and classroom situation. Students made good project leaders therefore learned leadership.

3. Regarding the teacher. Much work is necessary for planning the project. The teacher had to maintain close contact with the students at all times while in the field. Projects of this nature required more time than average classroom sessions. The students required more guidance and direction than they normally require. Results of the projects were more easily recognized than in routine classroom work and proved to be more beneficial than mere classroom recitations.

CONCLUSIONS

1. Worthwhile progress in training high school students in the restoration of forests and in care of the present forests will come from an intelligent selection of teaching means and agencies; and from subject matter presented in such a way as to motivate the individual into a more active acceptance of the facts. Forest appreciation will develop in the students an appreciation of their relationship to the environment in which they live, and thereby contribute to the improvement of people.

2. The projects presented in this study did not and were not intended to cover the total field of forestry. These are more stepping stones, suggestions and aids. It was seen as a challenge and need to the author to take steps in the classroom to try stopping the useless waste of our most valuable resources. It was further the hope that some high school student might become interested in forestry as a career because of an introduction to it in a science course.

3. Projects of this type, with proper preparation on the part of the teacher and the pupils, not only furnish wonderful learning experiences but help develop the initiative and thought processes of the individual and the group. They help establish in the learner a keener sense of observation.

4. These projects gave the student leaders a chance to lead and to help the other students. The smartest students helped the slower students and, not only did it help the slower student but the teaching student as well. The author feels that no one teacher could do the job that was done alone with such a large group of students, but only with the aid of cadre workers who were truly interested, could these projects have been completed. The success of these forestry projects depended to a great extent on the students whose interest remained high at all times.

5. Films were a good source of reference material but the students actually gained more by being able to see things and do things at first hand in the outdoors laboratory.

6. Students will participate in projects of this type who did not take active part in regular classroom routine. They want to be shown what to do and how to do it and they are anxious to give it their best.

7. After several hours on the trail with students as guides and lecturers, the supervisor of the secondary schools was very favorably impressed with the type of work and projects carried out by the students. He concluded that more work of this type should be and could be carried out in other schools.

RECOMMENDATIONS

Based on the findings of this investigation and study, the following recommendations for consideration seem reasonable:

1. That students in the secondary schools be given a basic course in forestry and forest conservation.
2. That the course should be a supplement to the biology text currently in use.
3. That this course should consume no more than four to six weeks study.
4. That this course, where time is limited, should be correlated with the springtime biology unit.
5. That more projects of this nature should be used in science courses.
6. That this study be made available to any teacher interested in a similar undertaking to help improve our forest situation.

SUGGESTIONS FOR FURTHER STUDY

This investigation reveals a need for the following studies:

1. A similar study in a city school.
2. A similar study in a comparable school.
3. A study in comparison of the findings of these studies.

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BIBLIOGRAPHY

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APPENDIX

BULLETINS

Farmers Bulletins:

1256 -- Slash Pine
1486 -- Long Leaf Pine Primer
1517 -- Loblolly Pine
1671 -- Short Leaf Pine
1405 -- Windbreaks as a Farm Asset
1492 -- Arbor Day: Its Purpose and Observance
1813 -- Prevention and Control of Gullies
1767 -- Soil Defense in the Piedmont
1210 -- Measuring and Marketing Farm Timber
1366 -- Production of Maple Syrup and Sugar
1756 -- Selection of Lumber for Farm and Home Building

Miscellaneous Publications:

162 -- Our Forests: What They Are and What They Mean To Us
357 -- Southern Pines Pay
196 -- Floods and Accelerated Erosion
247 -- Forests and Permanent Prosperity
--- -- What Forests Give

Leaflets:

29 -- The Farm Woods -- A Savings Bank
153 -- How to Cut Southern Farm Timber for Steady Profit
155 -- Growing Nursery Stock of Southern Pines
156 -- Harvesting and Selling Seed of Southern Pines
159 -- Planting Southern Pines

MOTION PICTURE FILMS

The following films are loaned without charge, except for return transportation cost, from the Motion Film Library, U. S. Forest Service, Southern Region, Glenn Building, Atlanta 3, Georgia. They are 16 mm and will have to be projected on a sound projector.

Approximate running time: 1 reel, 15 minutes; 2 reels, 30 minutes; 3 reels, 45 minutes.

FOREST FIRE PREVENTION

1. Dead Out. 2 reels (color)

   A film about the harm man-set woods fires can do to timber, homes, and people. Filmed in the south, the movie is based on actual happenings.

2. The Frying Pan and the Fire. 2 reels (color)

   Two girls, one woodwise and the other not, go to the forest for a camping trip. The one not woodwise builds a fire and leaves it, then it destroys the camp. The picture illustrates how the average camper should build his campfire and if it should get away, what he can do to stop it.

3. Forest Smoke Chasers. 3 reels (color)

   This film shows correct action in putting out a small lightning fire from the time the smoke chaser leaves the lookout, after spotting the fire, until final cleanup.

4. Pine Ways to Profit. 2 reels (color)

   The old custom of burning the woods presents the most serious obstacle to forest management in the southern pine region. This film exposes the fallacies of this custom and shows the benefits of good management of southern pine forests.

FOREST MANAGEMENT

1. Guardians of the Wild. 1 reel

This film gives a concise picture of the Forest Ranger at work. It reveals the ideals of public service that motivate him and some of the benefits that America receive from his activities.

2. The Woods and A Way. 3 reels (color)

The farm woods provide a way for a southern family to meet an emergency and build a better life. Careful woodland management supplements the family income as the farm land is built up, providing some of the conveniences that would not otherwise have been available.

PUBLIC BENEFITS OF FORESTS

1. Forests Forever. 3 reels (color)

Perpetuation of our timber supply is a problem of immediate national concern and since private forest lands supply nearly 95% of all our forest products, the way they are managed is of daily importance to millions of individual Americans. This picture shows what can be done to stop destructive cutting practices, to restore and maintain a thrifty growing stock of valuable trees and to safeguard forest production for the years' ahead.

2. Tree of Life. 2 reels

The theme is sustained yield management of forests. The part forests play in community prosperity and improved standards of living when they are managed for sustained yield of their products is dramatically protrayed.

3. Trees to Tame the Wind. 2 reels (color)

This picture depicts the success of the windbreaks and shows their effects on the lives and fortunes of the people who have taken advantage of them.

WATERSHED MANAGEMENT

1. Lifeblood of the Land. 2 reels (color)

What we do with our forests and grass-covered lands can have and does have a profound effect on our water supplies. This picture shows how we create wealth if we maintain this God-given absorbent soil covering and how we invite disaster if we destroy it.

2. Adventures of Junior Raindrop. 1 reel (color)

Animated cartoon of a raindrop's visit to earth. Shows the need for good watershed management practices by giving contrasting results of good and poor practices.

WILDLIFE MANAGEMENT

1. Realm of the Wild. 3 reels (color)

Filmed in their natural haunts, amid scenes of breathtaking beauty, wild creatures by the hundreds are the actors in this film. We see how vigorous, healthy wildlife populations can be maintained only by limiting the number of animals to keep them in balance with their limited food supplies.

SOIL EROSION AND FLOOD CONTROL

1. The River. 3 reels

A dramatic documentary film of the Mississippi River -- what it has done, and what man has done to it. A persuasive indictment of our practices of the past, and what should be done in the future if we are to avoid soil and lumber losses and the disastrous effects of floods.

2. Raindrops and Soil Erosion. 2 reels (color)

This film shows the tremendous part raindrops play in causing the widespread loss of topsoil from the fields of farms that produce our food and clothing.